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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to nonaqueous electrolyte excellent in the charging and discharging characteristic, and the rechargeable battery using it. It is related with nonaqueous electrolyte suitable for the lithium secondary battery which contains the anhydride of sulfonic acid and carboxylic acid in details more, and the rechargeable battery using it.

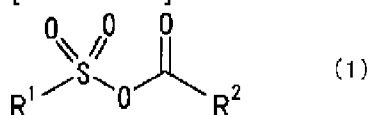
[0002]

[Background of the Invention]The cell using nonaqueous electrolyte is high tension, and has high energy density.

Since reliability, such as keeping, is high, it is widely used as a power supply of consumer electronics.

[0003]There is a nonaqueous electrolyte secondary battery as such a cell, and the typical existence is a rechargeable lithium-ion battery. As a nonaqueous solvent used for it, the carbonate compound with a high dielectric constant is known, and use of various carbonate compounds is proposed. As an electrolysis solution, said high permittivity carbonate compound solvents, such as propylene carbonate and ethylene carbonate, The solution which mixed electrolytes, such as LiBF_4 , LiPF_6 , LiClO_4 , LiAsF_6 , LiCF_3SO_3 , and Li_2SiF_6 , is used for the mixed solvent with low viscosity solvents, such as diethyl carbonate.

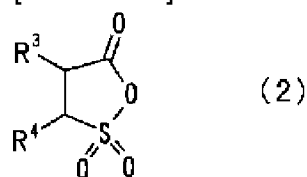
[0004]On the other hand, research of the electrode is also advanced aiming at high-capacity-izing of a cell, and the occlusion of lithium and the carbon material which can be emitted are used as a negative electrode of a rechargeable lithium-ion battery. Since it has the features, like discharge potential is flat and there is, especially high crystallinity carbon, such as black lead, is adopted as a negative electrode of most rechargeable lithium-ion batteries marketed now.



group of the carbon numbers 1-10.) R^1 and R^2 may be combined mutually.

[0010] Nonaqueous electrolyte whose anhydride of said sulfonic acid and carboxylic acid is a compound expressed with a following general formula (2) is a desirable mode of this invention.

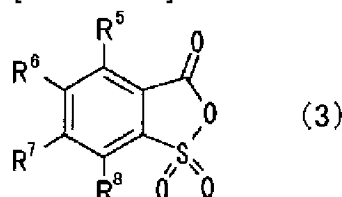
[Formula 6]



(R^3 in a formula and R^4 may be the same, or may differ from each other, and are an organic group of hydrogen, halogen, or the carbon numbers 1-10.)

[0011] The nonaqueous electrolyte whose anhydride of said sulfonic acid and carboxylic acid is a compound expressed with a following general formula (3) is a desirable mode of this invention.

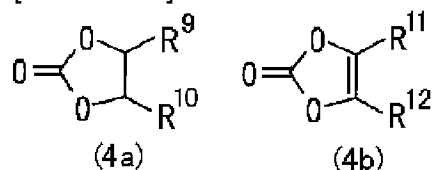
[Formula 7]



(R^5 in a formula - R^8 may be the same, or may differ from each other, and are an organic group of hydrogen, halogen, or the carbon numbers 1-10.)

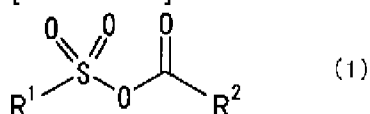
[0012] The aforementioned nonaqueous electrolyte which is that in which the aforementioned nonaqueous solvent contains the anhydride of said sulfonic acid and carboxylic acid and at least one sort chosen from the cyclic carbonate expressed with a following general formula (4a) or (4b) and/or chain carbonic ester is also a mode with preferred this invention.

[Formula 8]



(Into a formula (4a) (4b), R^9 - R^{12} may be the same, or may differ from each other, and are an alkyl group of a hydrogen atom or the carbon numbers 1-6.)

[0013] This invention provides the rechargeable battery containing the aforementioned nonaqueous electrolyte.



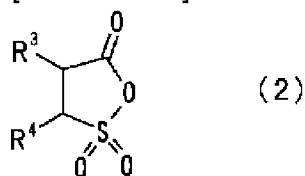
dimethylvinyl group; An ethynyl group, Alkynyl groups, such as 1-propynyl group, 2-propynyl group, 1-butylnyl group, 2-butylnyl group, and 3-butylnyl group; aryl groups, such as a phenyl group, a methylphenyl group, an ethyl phenyl group, a vinyl phenyl group, and an ethynyl phenyl group, can be raised.

[0020]As a halogenated hydrocarbon group, a trifluoromethyl group, a trifluoroethyl group, Alkyl halide groups, such as a pentafluoroethyl group; aryl halide groups, such as a fluorovinyl phenyl group, a fluoroethynyl phenyl group, a fluorophenyl group, a difluoro phenyl group, a trifluoro methylphenyl group, and a chlorophenyl group, can be mentioned.

[0021]A fluoro methoxypheny group, a difluoro methoxypheny group, etc. can be illustrated as a halogenated hydrocarbon group containing a hydrocarbon group containing a hetero atom or a hetero atom.

[0022]An anhydride of sulfonic acid and carboxylic acid which have the structure which R^1 and R^2 combined in said general formula (1) can also be used conveniently. A compound expressed with the following general formulas (2) as an example of such a compound can be illustrated.

[Formula 10]



[0023] R^3 in a formula and R^4 may be the same, or may differ from each other -- hydrogen, halogen, or a carbon number -- 1-20 -- it is an organic group of the carbon numbers 1-10 preferably. R^3 and R^4 may combine with each other, and may form the ring. As an organic group, a hydrocarbon group, a halogenated hydrocarbon group, the hydrocarbon group containing a hetero atom, the halogenated hydrocarbon group containing a hetero atom, etc. are mentioned. Oxygen, nitrogen, sulfur, Lynn, boron, etc. are mentioned as a hetero atom. The basis same as a desirable example of the organic group of the carbon numbers 1-10 as having described above can be mentioned.